WHAT IS CLAIMED IS:

1   1.   A system for estimating inputs and outputs of a

2   digital transmission system, comprising:

3   a receiver front-end configured to receive an observed

4   digital signal in the digital transmission system;

5   a forward recursion element adapted to receive the

6   observed digital signal, and generate a first sequence of

7   soft information by performing a forward recursion;

8   at least one forward channel estimator adapted to

9   receive the observed digital signal and said first sequence

10   of soft information, said at least one forward channel

11   estimator operating to estimate channel parameters using

12   said first sequence of soft information;

13   a backward recursion element adapted to receive the

14   observed digital signal, and generate a second sequence of

15   soft information by performing a backward recursion;

16   at least one backward channel estimator adapted to

17   receive the observed digital signal and said second sequence

18   of soft information, said at least one backward channel

19   estimator operating to estimate channel parameters using

20   said second sequence of soft information; and

21   a combiner configured to compute a transitional

22   information that ties forward and backward estimates of said

23   first and second sequences of soft information together,

24   said combiner operating to generate soft information on the

25   inputs and outputs of the transmission system by combining

26   updated first and second sequences of soft information and

27   said transitional information.

1   2.   The system of claim 1, wherein said forward

2   recursion element is a Trellis-based forward operator, and

3   said backward recursion element is a Trellis-based backward

4   operator,

5   where each operator generates a sequence of Trellis

6   state soft information updates.

1   3.   The system of claim 2, wherein each of said

2   Trellis-based forward operator and backward operator is a

3   min/sum operator.

1   4.   The system of claim 3, wherein each of said

2   min/sum operators performs min/sum operations on said

3   sequence of Trellis state soft information updates.

1   5.   The system of claim 4, wherein each of said

2   min/sum operators computes soft output for the inputs and

3   outputs defined by Trellis state transition.

1   6.   The system of claim 5, wherein said soft output

2   for the inputs and outputs defined by Trellis state

3   transition is computed as min/sum of a starting state

4   forward soft information, said Trellis state transition, an

5   ending state backward soft information, and a binding

6   factor.

1   7.   The system of claim 2, wherein each of said

2   Trellis-based forward and backward operators is a

3   sum/product operator.

1   8.   The system of claim 2, wherein each of said

2   Trellis-based forward and backward operators is a

3   min/product operator.

1   9.   The system of claim 2, wherein each of said

2   Trellis-based forward and backward operators is a

3   max/product operator.

1   10.   The system of claim 2, wherein each of said

2   Trellis-based forward operator and backward operator is a

3   min*/sum operator.

1   11. The system of claim 2, wherein each of said

2 forward and backward operators includes a Kalman filter

3 channel estimator for each Trellis state.

1   12. The system of claim 2, wherein each of said

2 forward and backward operators includes a least mean-square

3 estimator for each Trellis state.

1   13. The system of claim 2, wherein each of said

2 forward and backward operators includes a non-linear

3 estimator for each Trellis state.

1   14. The system of claim 13, wherein said non-linear

2 estimator is a phase-locked loop.

1   15. The system of claim 2, wherein each of said

2 forward and backward operators includes an open-loop

3 estimator for each Trellis state.

1   16. A method for estimating inputs and outputs of a

2 digital transmission system, comprising:

3   receiving an observed digital signal in the

4 digital transmission system;

5   generating a first sequence of soft information by

6 performing a forward recursion;

7   estimating channel parameters using said first

8 sequence of soft information and said observed digital

9 signal;

10   generating a second sequence of soft information

11 by performing a backward recursion;

12   estimating channel parameters using said second

13 sequence of soft information and said observed digital

14 signal;

15   computing a transitional information that ties

16 forward and backward estimates of said first and second

17 sequences of soft information together; and

18   generating soft information on the inputs and

19 outputs of the transmission system by combining updated

20 first and second sequences of soft information and said

21 transitional information.

1 17. An iterative receiver system, comprising:

2 a channel processor configured to receive a

3 plurality of coded symbols, said channel processor operating

4 to produce and update soft information on said plurality of

5 coded symbols, where said channel processor is activated by

6 updated soft information on interleaved code symbols;

7 a soft-in/soft-out decoder configured to receive

8 said soft-information on said plurality of coded symbols,

9 said soft-in/soft-out decoder operating to compute soft

10 information on said coded symbols; and

11 an interleaver/de-interleaver pair operating to

12 pass said soft information to/from said channel processor

13 from/to said soft-in/soft-out decoder,

14 where after several iterations, final bit

15 decisions are made on uncoded bits by said soft-in/soft-out

16 decoder by thresholding the corresponding soft information

17 produced by said soft-in/soft-out decoder.

1